TITLE: WASHING MACHINE CLUTCH SYSTEM AND METHOD OF USE

BACKGROUND OF THE INVENTION

An improved top loading, vertical axis washing machine combines the benefits of a top loading washing machine with that of a front loading washing machine. While front loading machines are generally more economical with respect to water consumption and electrical usage, traditional top loading machines are preferred by many customers. Specifically, the improved top loading, vertical axis washing machine has been adapted to utilize an agitator system that mixes the clothes and articles in a rotational action that simulates the front loading machines but spins the clothing as the traditional top loading machines.

When using the improved top loading, vertical axis washing machine, it has been noticed that at the completion of the agitation mode of the wash cycle the clothing may have been positioned to create a load unbalance situation during the spin mode. The load unbalance situation may create stress upon the washing machine, disrupt efficient removal of water from the clothing, and create an undesirable sound noticeable by the user. Therefore, an objective of the present invention is the provision of a system that recenters the wash load to alleviate the load unbalance situation.

The improved top loading, vertical axis washing machine is typically driven by a motor that may operate in a forward direction to drive the agitators and a rearward direction to drive a spin basket. A clutch system is typically used to selectively engage the agitators or the spin basket. However, the clutch system used in the prior art may create a load unbalance situation during the spin mode. Therefore, another objective of the present invention is the provision of a clutch system that reduces the occurrence and severity of a load unbalance situation during the spin mode.

A further objective of the present invention is a clutch system that is economical to manufacture and to operate.

These and other objectives will become apparent from the following description of the invention.

SUMMARY OF THE INVENTION

The foregoing objects may be achieved by a clutch system that affects a changeover between the agitation mode and spin mode of a washing machine. The clutch system has a housing, an input shaft and a spinner support operably mounted to the housing. The housing has a first one-way clutch connecting the spinner support to the housing permitting relative rotation between the spinner support and the housing in a first direction and preventing relative rotation in a second direction. The housing, when rotated in a first direction, rotates the input shaft in the first direction and the first one-way clutch stops the spinner support from rotating to permit relative rotation between the spinner support and the housing and enable the agitation mode without the spin tub moving. The clutch system also has a second one-way clutch connecting the spinner support to the housing with an intermediate delay body having a relax position and a taut position. The second one-way clutch permits relative rotation between the spinner support and housing in the first direction and prevents relative rotation in a second direction. The housing when rotated in the second direction rotates the input shaft in the second direction, moves the delay body to permit relative rotation between the spinner support and the housing as well as moves the agitator system backward without movement of the spin tub, and then prevents relative rotation between the spinner support and the housing to enable the spin mode without engagement of centrally located agitator system.

The foregoing objectives may also be achieved using a method of using a clutch for a washing machine. The method having the steps providing a housing having an input shaft and a spinner support, providing a first one-way clutch connecting the spinner support to the housing, and providing a second one-way clutch connecting the spinner support to the housing with an intermediate spiral spring. The method also comprising the step rotating the housing in a first direction thereby rotating the input shaft in the first direction and the first one-way clutch stopping the spinner support from rotating and permitting relative rotation between the spinner support and the housing to enable the agitation mode without the spin tub moving. The method also having the step rotating the housing in a second direction thereby rotating the input shaft in the second direction, moving the spiral spring from a rest position to a taut position thereby permitting relative rotation between the spinner support and the housing and rotating the centrally located agitator system

backwards, and the second one way clutch preventing relative rotation between the spinner support and the housing when the spiral spring is taut to enable the spin mode without engaging the centrally located agitator system.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a perspective view of an improved top loading, vertical axis washing machine.

Figure 2 is a sectional view taken along lines 2-2 of Figure 1.

Figure 3 is a sectional view taken along lines 3-3 of Figure 1.

Figure 4 is an enlarged view of section 4-4 of Figure 3.

Figure 5 is an exploded view of the clutch system.

Figure 6 is a top view of the clutch system with the spring in a rest position.

Figure 7 is a top view showing the spring in the taut position.

Figure 8 is a perspective view of the lifter showing a lifter of the centrally located agitator system at rest after the agitation mode.

Figure 9 is a perspective view of the lifter rotated backwards prior to entering the spin mode.

DESCRIPTION OF THE PREFERRED EMBODIMENT

With reference to Figures 1 and 2, an improved top loading, vertical axis washing machine 10 includes a cabinet 12 having a control panel 14 and a door 16 movable between an open and closed position. A reversible drive motor 18 is mounted within the cabinet 12 and has a rotatable output shaft 20 which drives belt 22. The above construction of the washing machine 10 is conventional and does not form a part of the invention.

The present invention is directed towards a clutch system 24. The clutch system 24 is connected to the output shaft 20 of the motor 18 by belt 22. The clutch system 24 is mounted underneath static tub 26.

As seen in Figure 3, within the static tub 26 is a spin tub 28 and centrally located agitator system 30. The agitator system 30 has first and second lifters 32. The static tub 26 does not move whereas the spin tub 28 and the lifters 32 of the agitator system 30 rotate within the static tub 26 about a central axis during the spinning or water extraction portion

of the cycle. The agitator system 30 is provided within the wash basket 27 so as to rotate the clothes and other articles in a tumbling direction within the wash and rinse water during the agitation portion of the cycle. At least one lifter 32 is provided in the agitator system 30 and typically two lifters 32 are provided. The lifters 32 are equally spaced from the central axis. As most clearly seen in Figures 3, 8 and 9, the lifters 32 have the shape of a spherical segment so as to nest closely adjacent the interior surface of the wash basket 27. Each lifter 32 includes an axle or bearing surface 34 about which the lifter 32 rotates.

Referring to Figure 3 and 4, a ring gear 36 is located on the outer circumference of each lifter 32. The ring gear 36 is turned by transmission system 38. The transmission system 38 of the centrally located agitator system 30 is positioned within the spin tub and is connected to the spin tub 28 through bearing surfaces 40. These bearing surfaces 40 permit reverse torque to be applied to the spin tub 28 when the agitator system 30 is activated.

The spin tub 28 encircles the wash basket 27 with a top side part way up the wash basket 27 side and a bottom side partially under the transmission system 38. A spinner support 44 is attached to the spin tub 28 which extends beneath the transmission system and ends in a shaft that surrounds the input shaft 42.

As seen most clearly in Figure 4, the input shaft 42 drives the transmission system 38 in either a forward or backward direction. The input shaft 42 has an input pinion 48 which transmits forward or reverse torque from the input shaft 42 into the transmission system 38. The input shaft 42 rotates inside the spinner support 44 by turning on bearings 46 and 47.

As seen in Figures 4 and 5, the clutch system 24 has a pulley assembly or housing 50. The pulley assembly 50 has a base 52, a central member 54 adapted to attach the input shaft 42, a first annular wall 56 extending from the base 52 formed to be driven by the belt 22, and a second annular wall 58 extending from the base 52 and defining a spring chamber 60. A delay body or spiral spring 62 is positioned within the spring chamber 60 with an outer end 64 attached to the second annular wall 58 by a pin and an inner end 66 attached to a movable pin 68. In this configuration, the spiral spring 62 is movable between a rest position and a taut position as seen in Figures 6 and 7.

The spiral spring 62 functions as a delay body. As a delay body, the spiral spring 62 serves to prevent movement of the spinner support 44 for a predetermined number of

input shaft 42 rotations and to then permit the spinner support 44 to move at the same rotational speed as the input shaft 42. In the illustrated embodiment, the spiral spring 62 delays movement of the spinner support 44 for approximately 1.6 rotations of the input shaft 42 which engages the transmission system 38 to produce a 30 – 50 degree backward rotation. The delay body may be positioned on the outside of the housing or the inside of the housing. Additionally, the delay body may be a lost motion spring that is made of stainless steel or other non-reactive material.

As further seen in Figures 4 and 5, a lower ring 70 covers the spring chamber 60. The lower ring 70 has a base 72, a passageway 74 in the base 72 to prevent sliding of the movable pin 68 and at least one rib 76 that prevents movement of the spiral spring 62 beyond the taut position. The lower ring 70 also has a lower ring one-way clutch 78 in axial alignment with the center of the clutch system 24.

A clutch system 24 also has an upper ring 80 having a base 82 with an upper ring one-way clutch 84 attached within the base and in axial alignment with the center of the clutch system 24. Upper ring 80 also having members 86 that mate with the static tub 26 to prevent the upper ring 80 from turning.

The lower ring and upper ring one-way clutch in one embodiment is a roller clutch manufactured by INA USA CORPORATION and specifically the HF 3520 Roller Clutch. It is to be understood that alternate one-way clutches are available and may be substituted for the roller clutch.

The upper ring one-way clutch 78 is also referred to as the first one-way clutch as it is being acted upon during the first mode in the wash cycle, i.e. the agitation mode. The lower ring one-way clutch 84 is also referred to as the second one-way clutch as it is being acted upon during the second mode in the wash cycle, i.e. the spin mode.

The clutch system 24 has a cylindrical hub 88 that engages the spinner support 44. The cylindrical hub 88 has an outer face 90 that engages the lower ring one-way clutch 78 and the upper ring one-way clutch 84. The cylindrical hub 88 has an inner surface that connects to the spinner support 44 while permitting the input shaft 42 to rotate without obstruction. A cover 92 is attached to the pulley assembly 50 by screws 94.

As seen in Figures 3 and 4, the spinner support 44 rotates within the static tub freely and is joined to the static tub 26 by two-way lower bearing 100 and two-way upper bearing

102. In an alternative embodiment, the upper ring one-way clutch 84 may be removed to save costs and the two-way lower bearing 100 replaced with a one-way clutch.

In use, the clutch system 24 functions to affect a changeover between an agitation mode and a spin mode of the washing machine 10. The washing machine 10 is loaded with clothing and the wash basket 27 is filled with water. The clothing is washed and rinsed with the agitation system 30 engaged. In agitation mode, the motor 18 is run in a first direction to turn belt 22 to begin moving the housing or pulley assembly 50 of the clutch system 24. This rotational movement is transferred to the input shaft 42 that is attached to the clutch system 24 by threaded bolt 96. The input shaft 42 is attached to an input pinion 48 which drives the transmission system 38. The transmission system 38 then drives the agitator system 30 and its lifters 32.

When the agitation system 30 is in use, it exerts a reverse torque upon the spin tub 28 and spinner support 44 which would normally cause backward rotation of the spin tub 28 and spinner support 44. The upper ring one-way clutch 84 stops the spinner support 44 from this rotation to permit the agitation mode to continue without the spin tub 28 or spinner support 44 moving.

After the agitation mode, the washing machine 10 enters into a spin mode. However, the agitation mode may leave the clothing load unbalanced and a recentering of the load is done in an attempt to reduce the occurrence and severity of load unbalance during the spin mode.

When entering the spin mode, the motor 18 is run in a second direction reverse from the first. The belt 22 drives the clutch system 24 causing the lost motion spiral spring 62 to wrap around the ribs 76 on the lower ring 70. Figures 6 and 7 illustrate the spiral spring being moved between the rest position and the taut position and Figures 8 and 9 illustrate a lifter 32 moved from a start position to a reverse position. While the spiral spring 62 is moving from a rest position to a taut position, the input shaft is driving the transmission 38, lifters 32 and clothes in a reverse tumble to enable a centering of the load. The lifters 32 will reverse through a range of between 30° to 50° with a preferred reverse being 40° before the lower ring 70 locks into the lower ring one-way clutch 78. With the lower ring 30 locked in place the motor 18 can then drive the hub 88 and spinner support 44 to rotate the spin tub 28. At this point, the lower ring one-way clutch 78 forces the

spinner support 44 to move at the same speed as the input shaft 42; therefore, the spin tub 32 will begin rotating without the agitator system 30 turning because the input shaft 42 and the spinner support 44 are rotating at the speed and consequently there is no relative rotation in the transmission system 38.

Whereas the invention has been shown and described in connection with the preferred embodiments thereof, it will be understood that many modifications, substitutions, and additions may be made which are within the intended broad scope of the following claims. From the foregoing, it can be seen that the present invention accomplishes at least all of the stated objections.